

What is Claimed is:

1. A method for manufacturing a contact plug of a semiconductor device, the method comprising:
 - 5 forming a wordline pattern having a sequentially stacked structure of a wordline conductive material and a hard mask nitride film on a semiconductor substrate;
 - forming a nitride film spacer on a side of the wordline pattern;
 - forming a planarized interlayer insulating film on the wordline pattern;
 - etching the interlayer insulating film until the substrate is exposed, to form a contact hole;
- 10 forming a polysilicon layer on the surface of the interlayer insulating film where the contact hole is formed; and
 - 15 performing a chemical mechanical polishing (CMP) process on the polysilicon layer and the interlayer insulating film using an acidic CMP slurry for oxide film having a pH ranging from 2 to 7 containing an oxidizer until the hard mask nitride film is exposed.
- 20 2. The method according to claim 1, wherein the oxidizer is selected from the group consisting of hydrogen peroxide (H_2O_2), periodic acid (H_2IO_6), ferric nitrate [$Fe(N_3O_9)$], and combinations thereof.
3. The method according to claim 1, wherein the oxidizer is present in an amount ranging from 1 to 40 vol% based on the CMP slurry.
- 25 4. The method according to claim 1, wherein the oxidizer is present in an amount ranging from 20 to 30 vol% based on the CMP slurry.
5. The method according to claim 1, wherein the acidic slurry has a pH ranging from 2 to 5.
- 30 6. The method according to claim 1, wherein the acidic slurry comprises an abrasive selected from the group consisting of silica (SiO_2), ceria (CeO_2), zirconia (ZrO_2), alumina (Al_2O_3), and combinations thereof.

7. The method according to claim 6, wherein the abrasive is present in an amount ranging from 10 to 50 wt% based on the CMP slurry.

8. The method according to claim 7, wherein the abrasive is present in 5 an amount ranging from 25 to 35 wt% based on the CMP slurry.

9. The method according to claim 1, wherein the polysilicon layer is formed using one selected from the group consisting of P-doped amorphous silicon film, P-doped polysilicon film, P-doped epitaxial silicon film, and combinations 10 thereof.

10. The method according to claim 1, wherein the wordline conductive material is formed of a SiON or organic bottom ARC layer.

15 11. The method according to claim 1, wherein the interlayer insulating film is formed of a BPSG (borophosphosilicate glass) or HDP (high density plasma) oxide film.

12. A method for manufacturing a contact plug of a semiconductor 20 device, comprises:

forming a wordline pattern having a sequentially stacked of a wordline conductive material and a hard mask nitride film on a semiconductor substrate;

forming a nitride film spacer on a side of the wordline pattern;

forming a planarized interlayer insulating film on the wordline pattern;

25 etching the interlayer insulating film until the substrate is exposed to form a contact hole;

forming a polysilicon layer on the surface of the interlayer insulating film where the contact hole is formed; and

30 performing a CMP process on the polysilicon layer and the interlayer insulating film using a CMP slurry for oxide film having a pH ranging 2 to 7 containing H₂O₂ in an amount ranging from 1 to 40 vol%.

13. The method according to claim 12, wherein the oxidizer is present in an amount ranging from 20 to 30 vol% based on the CMP slurry.

14. The method according to claim 12, wherein the acidic slurry has a pH ranging from 2 to 5.

5 15. The method according to claim 12, wherein the acidic slurry comprises an abrasive selected from the group consisting of silica (SiO₂), ceria (CeO₂), zirconia (ZrO₂), alumina (Al₂O₃), and combinations thereof.

10 16. The method according to claim 15, wherein the abrasive is present in an amount ranging from 10 to 50 wt% based on the CMP slurry.

17. The method according to claim 15, wherein the abrasive is present in an amount ranging from 25 to 35 wt% based on the CMP slurry.

15 18. The method according to claim 12, wherein the polysilicon layer is formed using one selected from the group consisting of P-doped amorphous silicon film, P-doped polysilicon film, P-doped epitaxial silicon film, and combinations thereof.

20 19. The method according to claim 12, wherein the wordline conductive material is formed of a SiON or organic bottom ARC layer.

25 20. The method according to claim 12, wherein the interlayer insulating film is formed of a BPSG (borophosphosilicate glass) or HDP (high density plasma) oxide film.